

BLACK SEA SRIA IMPLEMENTATION AND OVERVIEW OF THE IMPACT OF BRIDGE-BS

Bariş Salihoğlu, BRIDGE-BS Coordinator
Director, METU Institute of Marine Sciences

sabaris@metu.edu.tr

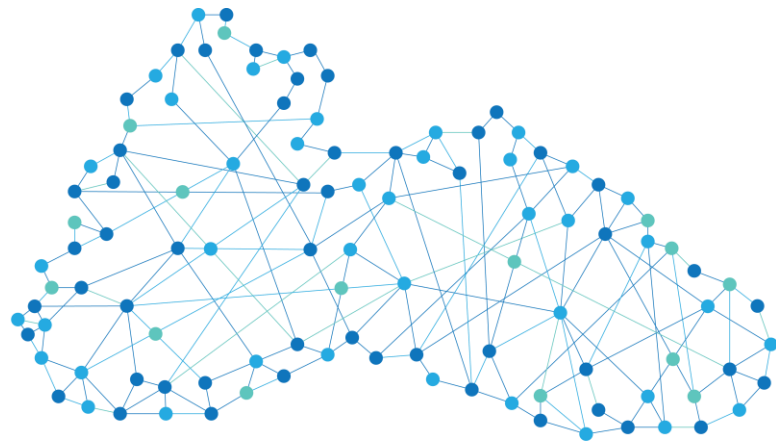


BRIDGE-BS



*This project has received funding from the European Union's Horizon 2020
Research and Innovation Programme under Grant Agreement No:101000240.*





CONNECT  BLACK SEA



- 01 Support the Black Sea Blue Growth Initiative to consolidate and update the SRIA
- 02 Develop the SRIA Implementation Plan
- 03 The establishment of an **Operational Network of Funders** for the Black Sea Region
- 04 Support the design and implementation of new transnational joint activities
- 05 Making the Black Sea visible through empowered Black Sea societies

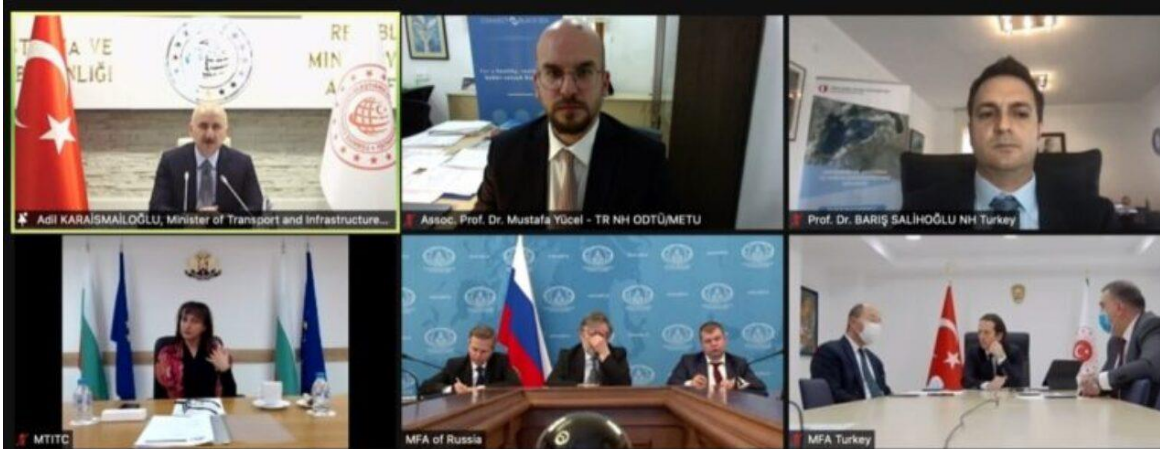
Black Sea **Strategic Research and Innovation Agenda (SRIA)** and its **Implementation Plan (IP)** developed.



Many International and National events organized on the Black Sea SRIA and IP.



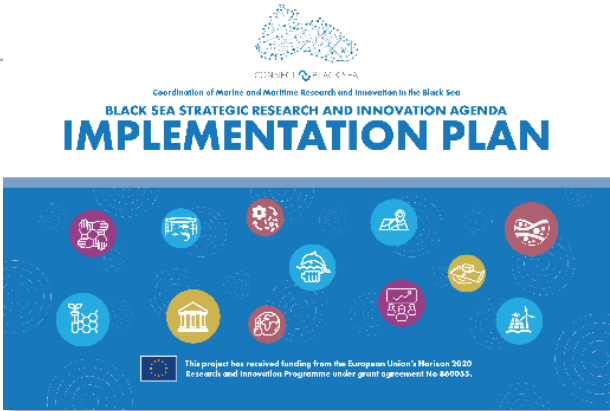
Common Maritime Agenda and links with **the ministries and funding agencies** strengthened to adopt the SRIA priorities through science-diplomacy.



Black Sea SRIA IP Launch at the European Parliament, May 2023

BLACK SEA SRIA IMPLEMENTATION PLAN

Black Sea SRIA IP translates SRIA Goals into concrete, cutting-edge science and technology actions.



- SRIA PILLAR 1**
-  1 DIGITAL TWIN OF THE BLACK SEA
 -  2 EFFECT OF MULTIPLE STRESSORS ON THE BLACK SEA ECOSYSTEM
 -  3 CHANGING BLACK SEA BIODIVERSITY AND ECOSYSTEM RESILIENCE UNDER CLIMATE CHANGE AND MULTISTRESSORS

- SRIA PILLAR 2**
-  4 ECOSYSTEM-BASED FISHERIES AND HIGH-TECH AQUA AND MARICULTURE
 -  5 BLUE BIOTECHNOLOGY
 -  6 HEALTH AND SAFETY FOR BLACK SEA COASTS
 -  7 MARINE LITTER
 -  8 MARINE RENEWABLE ENERGY

- SRIA PILLAR 3**
-  9 INNOVATIVE OBSERVING SYSTEMS
 -  10 BLACK SEA UNDERWATER AND COASTAL HERITAGE

- SRIA PILLAR 4**
-  11 INNOVATIVE APPROACHES TO CONNECT SCIENTISTS, POLICY MAKERS, INDUSTRY AND SOCIETY
 -  12 BLUE SKILLS AND CAPACITY BUILDING ON MARINE SCIENCES



ONF Meeting in Istanbul, November 2022

- Funding agencies of the Black Sea countries
- 6 Meetings between 2022 – 2023
- Co-developed the SRIA Implementation Plan
- 2 recent meetings in 2025



ONF Meeting in Bucharest, March 2023



ONF Meeting in Brussels, November 2025



EU Mission: Restore our Ocean and Waters



The European Green Deal



Sustainable Blue Economy Partnership



EU Blue Economy



The European Ocean Pact
Sustaining the ocean that sustains us



Black Sea SRIA



Burgas Vision Paper



Black Sea SRIA Implementation Plan



UN Ocean Decade



UN Sustainable Development Goals



UN Framework Convention on Climate Change



The Paris Agreement



EU's Strategic approach to Black Sea

ADVANCING BLACK SEA RESEARCH AND INNOVATION TO CO-DEVELOP BLUE GROWTH WITHIN RESILIENT ECOSYSTEMS: BRIDGE-BS



Horizon 2020

Call: H2020-BG-2018-2020 (Blue Growth)

Topic: LC-BG-09-2019

Type of action: Research and Innovation Action

Proposal number: 101000240

Project acronym: BRIDGE-BS

Duration: 06.2021-12.2025

Coordinator: METU IMS (Türkiye)



BRIDGE-BS

Blue Growth Incubators | Service Dynamics | Empowered Citizens

OVERALL OBJECTIVE

BRIDGE-BS aims to advance the **Black Sea's marine research and innovation** to co-develop Blue Growth pathways under multi-stressors for the **sustainable utilization of the ecosystem services**. To do so it defines a **Safe Operating Space** for the Black Sea, develops an **ecosystem-based management framework**, enables **policy uptake** and fosters **citizen engagement**.



NODE 1:

ECOSYSTEM SERVICE DYNAMICS

To assess the status, and develop the multidisciplinary understanding and predictive tools on ecosystem functioning necessary to implement adaptive management



NODE 2:

BLUE GROWTH INCUBATORS

To provide an operational platform to translate scientific ideas into business opportunities and stimulate the ocean economy in the Black Sea



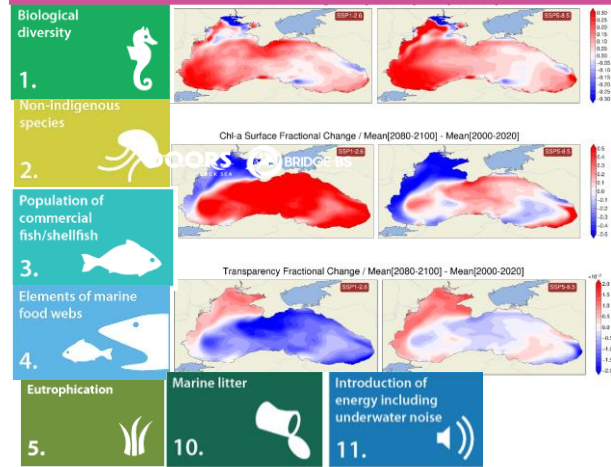
NODE 3:

EMPOWERED CITIZENS

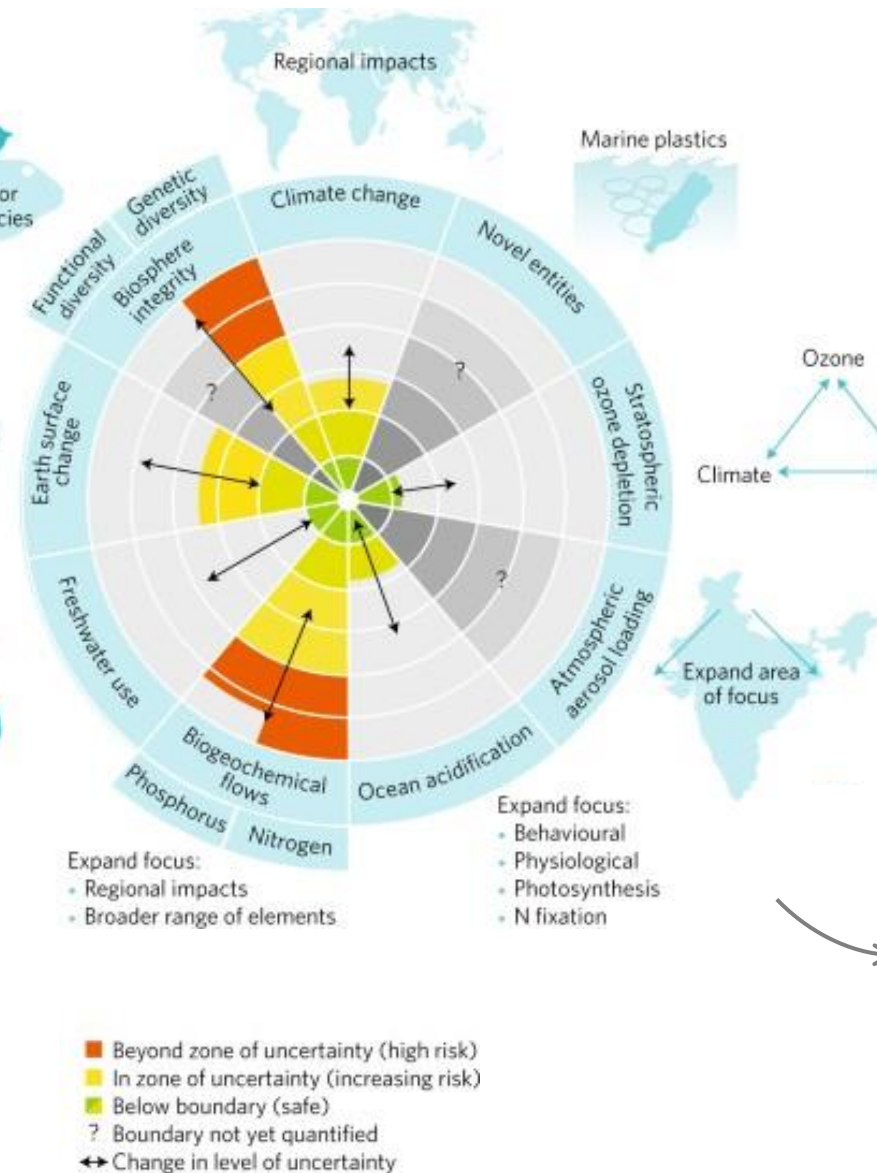
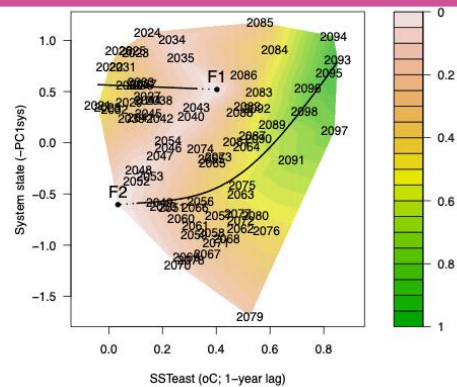
To support the development of a cohesive, knowledgeable, and literate Black Sea international community

SAFE OPERATING SPACE

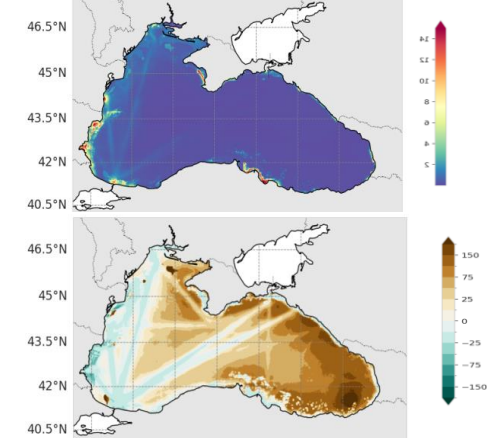
GES ANALYSES



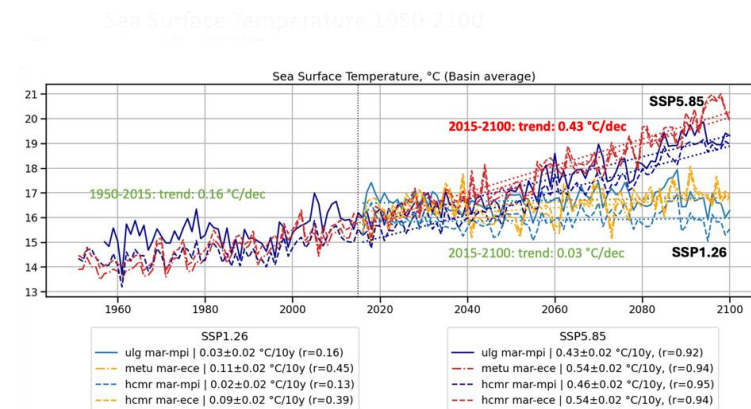
RESILIENCE ASSESMENT



RISK-BASED CUMULATIVE EFFECT ASSESSMENT



ENSEMBLE MODELING FRAMEWORK



NORTHWESTERN BLACK SEA (ODESSA BAY)

KEY MULTIPLE STRESSORS



KEY ECOSYSTEM SERVICES



WESTERN BLACK SEA (DANUBE DELTA REGION)

KEY MULTIPLE STRESSORS



KEY ECOSYSTEM SERVICES



WESTERN SHELF (VARNA & BURGAS)

KEY MULTIPLE STRESSORS



KEY ECOSYSTEM SERVICES



İSTANBUL SITE

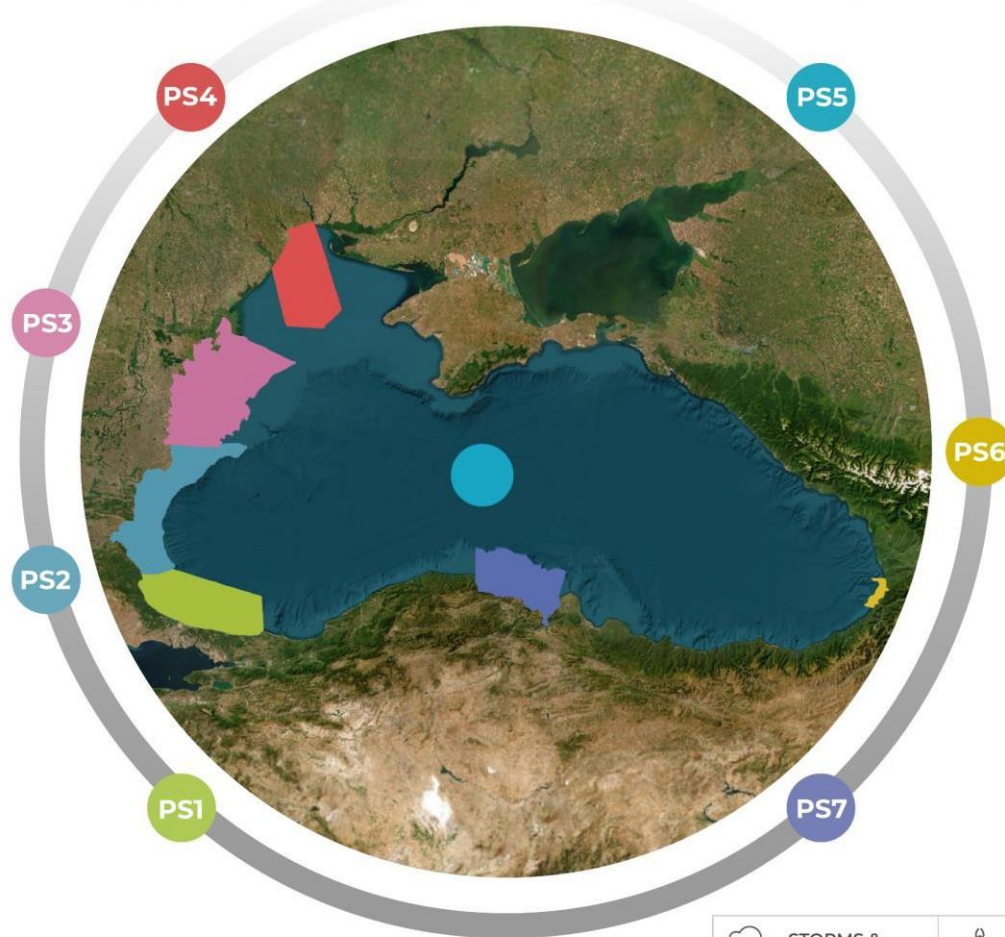
KEY MULTIPLE STRESSORS



KEY ECOSYSTEM SERVICES



PILOT SITES: KEY ECOSYSTEM SERVICES AND REGIONAL MULTI-STRESSORS



BASIN WIDE

KEY MULTIPLE STRESSORS



KEY ECOSYSTEM SERVICES



EASTERN BLACK SEA (BATUMI SITE)

KEY MULTIPLE STRESSORS

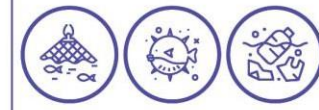


KEY ECOSYSTEM SERVICES



SOUTHWESTERN BLACK SEA (SINOP SITE)

KEY MULTIPLE STRESSORS



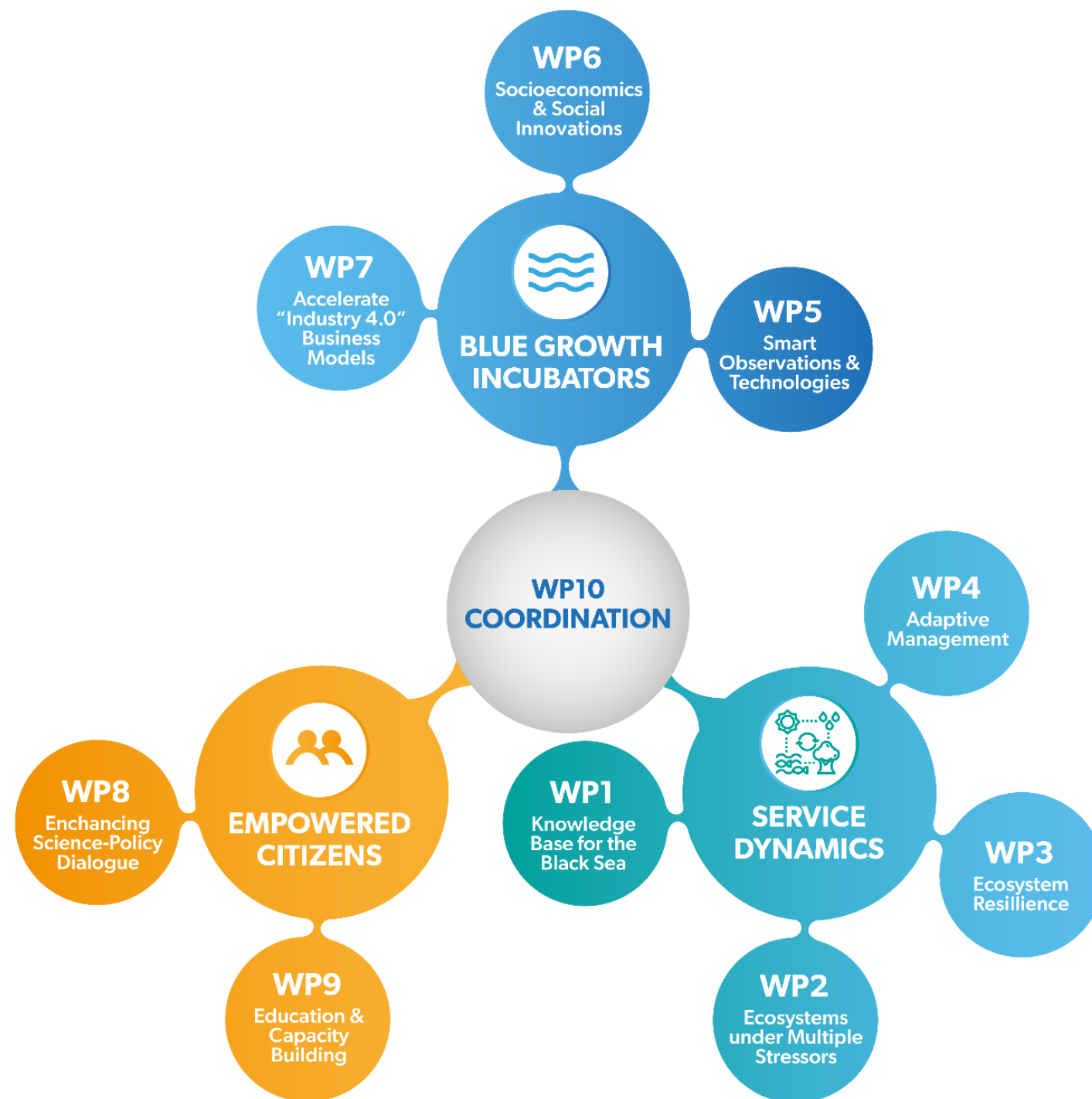
KEY ECOSYSTEM SERVICES



PROVISIONING: FISHERIES & AQUACULTURE	REGULATING & MAINTENANCE
CULTURAL SERVICES: RECREATION & TOURISM	PORTS & SHIPPING

CLIMATE CHANGE	ILLEGAL FISHING	STORMS & FLOODS	OVERFISHING	NUTRIENT LOADS & EUTROPHICATION	ACUTE POLLUTION
WATER QUALITY DETERIORATION	MILITARY-BASED PRESSURES	INVASIVE SPECIES & HABITAT LOSE	COASTAL EROSION		

BRIDGE-BS WORK PACKAGES embedded in Nodes





ENGAGING STAKEHOLDERS AND POLICYMAKERS

Local stakeholders were engaged with regional policymakers through participatory events and Living Labs.



ADVANCING BLUE ECONOMY NETWORK

The Black Sea Blue Economy R&I community was actively engaged, its growth accelerated, and networks strengthened.



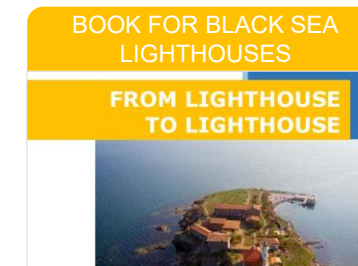
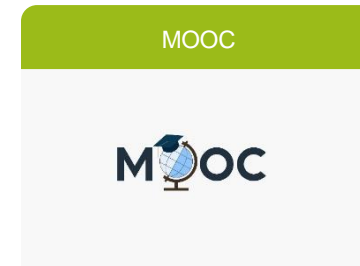
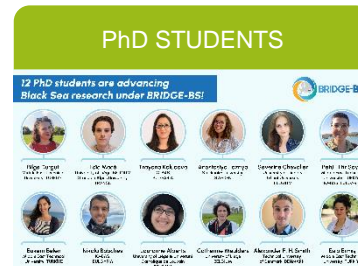
EMPOWERING ECOPs

Training and capacity-building activities enhanced the skills and expertise of Black Sea ECOPs.



BRIDGING THE SCIENCE AND SOCIETY

The public was reached through informative and engaging mediums, and science outreach.



INNOVATIVE TECHNOLOGIES DRIVING BRIDGE-BS RESEARCH

AMONG THE FIRST IN THE BLACK SEA!

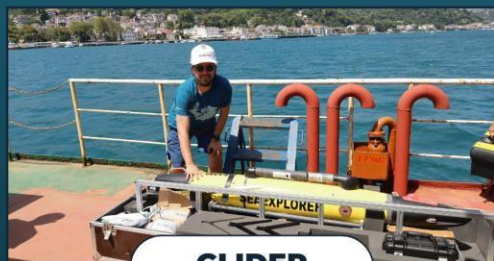
COLLABORATIVE RESEARCH CRUISES

- ✓ Harmonization of Methodologies
- ✓ Intercomparison of Results
- ✓ Temporal Data Comparison



**UAVS FOR JELLYFISH
MONITORING**

SMART MONITORING SYSTEMS



GLIDER



SCANFISH



**ENZYMES
METAGENOMICS**



**E-DNA
METABARCODING**



**BENTHIC
OBSERVING SYSTEMS**

NEW SENSORS AND TOOLS



**DIGITAL LIBRARY FOR
PHYTOPLANKTON**



**PCO₂
MONITORING**



**ACOUSTIC
JELLYFISH DETECTOR**



**ACOUSTIC MARINE
MAMMAL OBSERVING**



IN-SITU pH SENSOR



E-CHEM H₂S SENSOR



**RADIONUCLIDES
DETECTOR**



KNOWLEDGE BASE FOR THE BLACK SEA

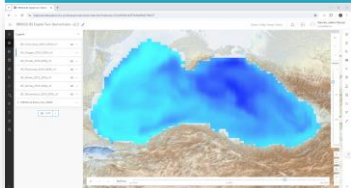


BRIDGE-BS

SAFE OPERATING SPACE



BRIDGE-BS DATABASE

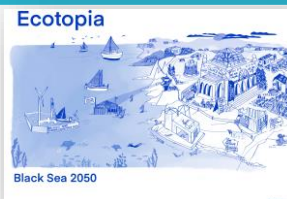


BLACK SEA BLUE ECONOMY OBSERVATORY

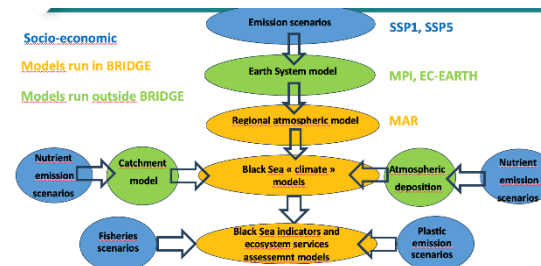


BLACK SEA BEO

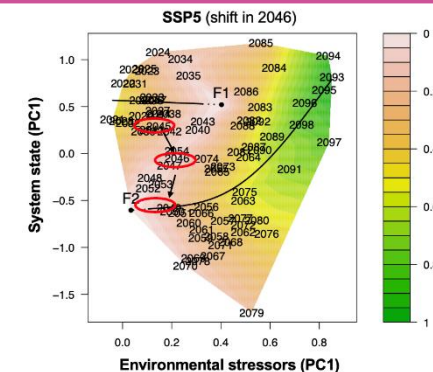
IMAGINARIES



ENSEMBLE MODELING FRAMEWORK



RESILIENCE ASSESMENT



BLACK SEA DIGITAL TWIN DEMONSTRATOR



Sign Up

BRIDGE BLACK SEA DIGITAL TWIN OCEAN DEMONSTRATOR

One of the First Examples of Digital Twin Ocean Demonstrators



Explore Physics & Biogeochemistry

Explore how the sea evolves under SSP future projections — visualize physical processes, biogeochemical cycles, and marine plastic transport.

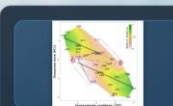
Launch



Higher Trophic Level

Visualize fish biomass and yield under different future SSP projections.

Launch



Resilience Assessment

Assess ecosystem & community resilience through indicators.

Launch



Cumulative Effect Assessment

Explore how multiple human activities and climate drivers cumulatively impact the Black Sea ecosystem.

Launch

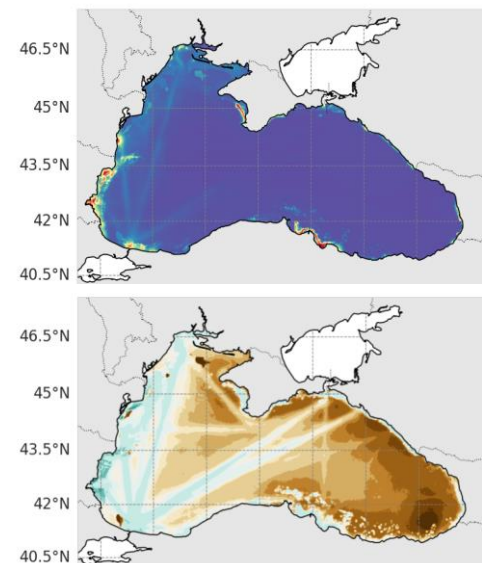


Blue Economy Observatory

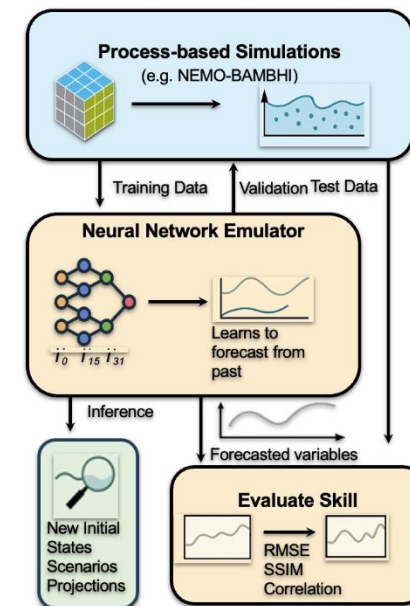
Monitor and explore socio-economic trends driving the Black Sea Blue Economy through interactive dashboards, indicators, and country fact sheets.

Launch

RISK-BASED CUMULATIVE EFFECT ASSESSMENT



AI-BASED EMULATOR





Black Sea Digital Ocean Demonstrator
integrating BRIDGE-BS models, scenarios, simulations, resilience analyses, boundaries definition, decision support tool, Database, Portal

Policy Brief and Roadmap
to provide support to policy makers




BRIDGE-BS Living Labs established in **5 Pilot Sites** engaging more than **400 stakeholders**

Joint Smart Observations And Technologies
which are tested and used in **33 multidisciplinary cruises**

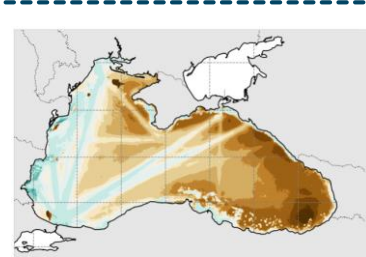


Black Sea Accelerator
provided mentoring and training support to **15 Start-ups**

Blue Economy Observatories
The first attempt to build a BEO dedicated to the Black Sea with a strong sustainability component.




BLACK SEA BEO



First Regional Tools for Safe Operating Space Cumulative Effect Assessment as a base for Tools for MSP, Tools for biodiversity, MUC (maritime use conflict analyses) PMAR (pressure model for marine cativities) Scenario Builder

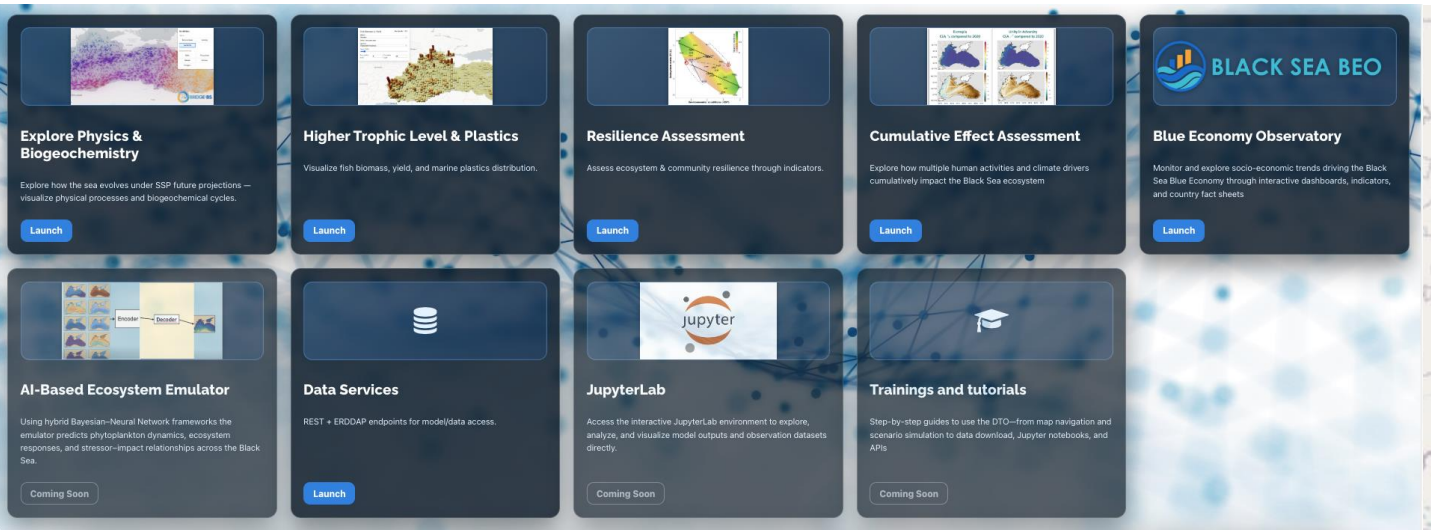
High impact Publications to ensure the outputs are accessible and usable for the community

Next Generation of ECOPs
Trained through diverse array of activities such as summer, winter schools Ambassador Programme, PhD Programme,



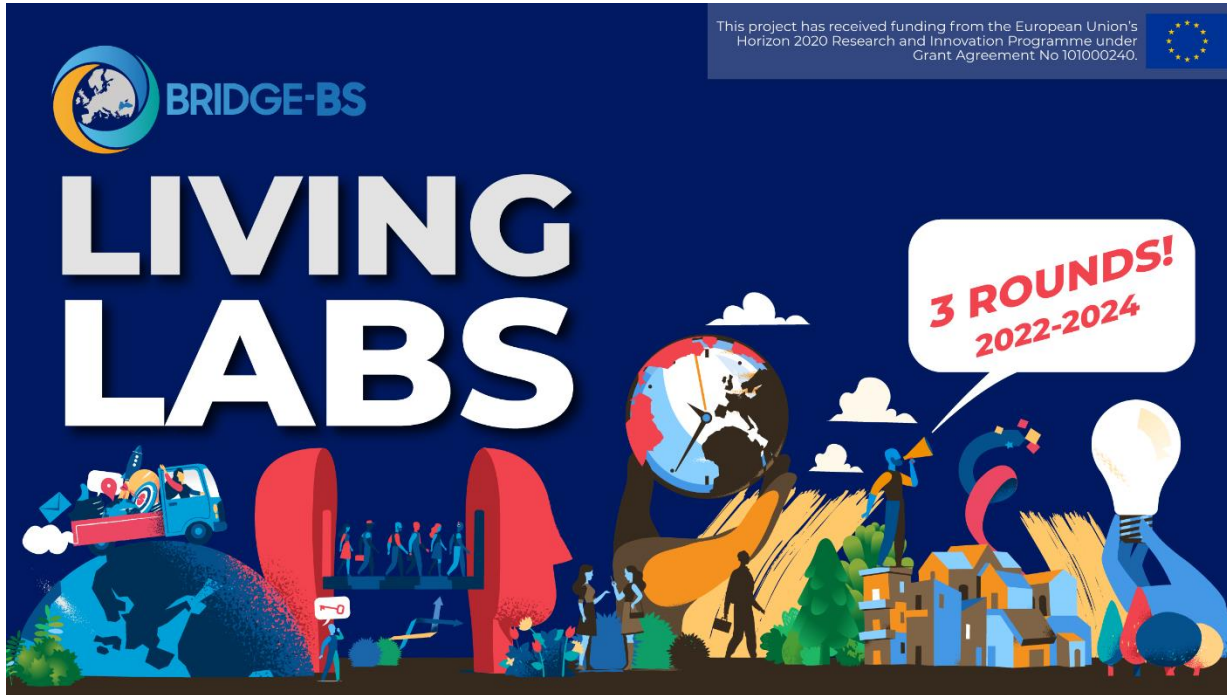
BRIDGE BLACK SEA DIGITAL TWIN OCEAN DEMONSTRATOR

One of the First Examples of Digital Twin Ocean Demonstrators

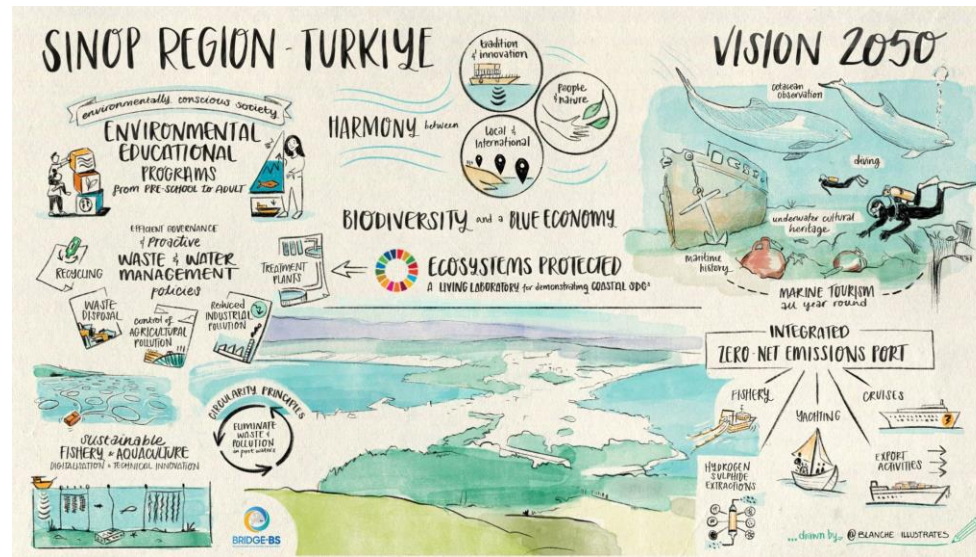


- **DTO Demonstrator** integrating BRIDGE-BS models, scenarios, simulations, resilience analyses, boundaries definition, decision support tool





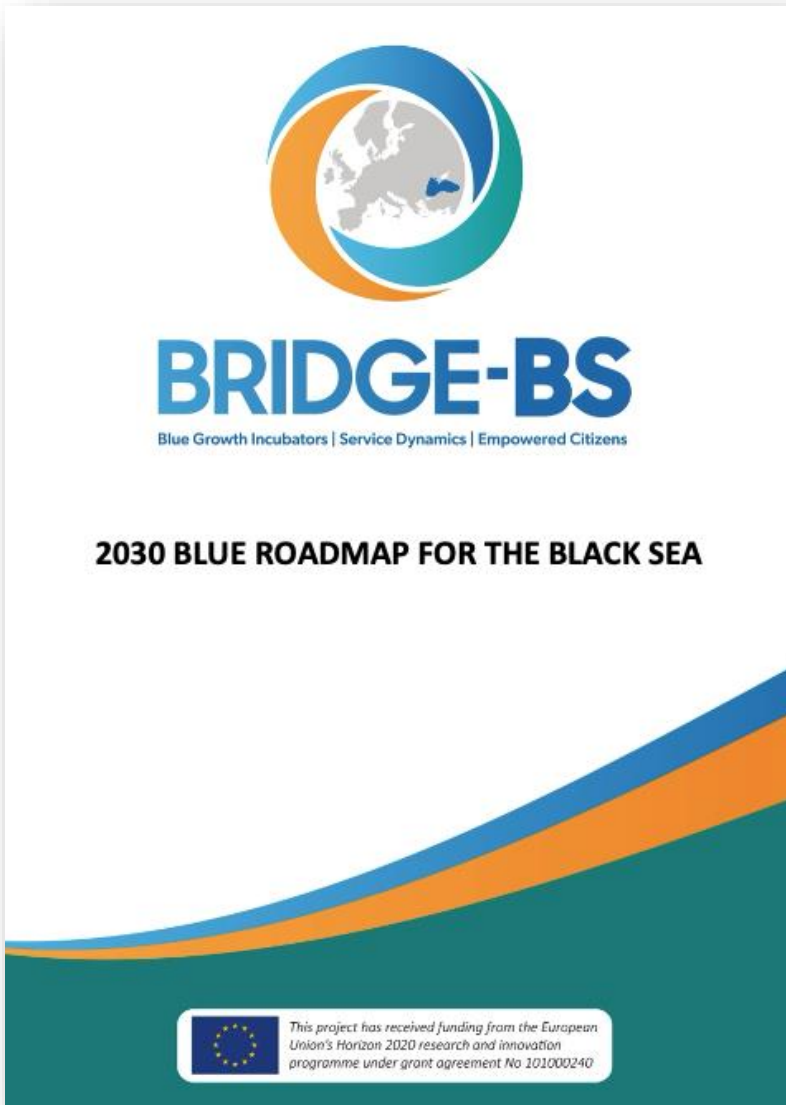
- **5 Pilot Sites established**
- **Stakeholder Vision for 2050 for each Pilot Site developed**





- **BRIDGE-BS works and outputs**
- **Recommendations for policy makers**
- **Recommendations for research and operational services**





- A key document that provides a common framework to **advance the project results** to the **next stage** towards their **implementation** at **policy level** to support the **sustainable Blue Economy** in the Black Sea.
- Detailed assessment of **how BRIDGE-BS outputs addresses the SRIA priorities**
- Promotes the balanced and sustainable development of the BE by supporting policy implementation, identifying funding priorities, consolidating key scientific knowledge, and enabling stronger regional cooperation.





- Water Resilience Strategy
- Water Framework Directive (WFD)
- Nature Restoration Regulation (NRR)
- Nature Directives (Habitats and Birds)
- EU Biodiversity Strategy for 2030
- EU Green Deal

- National Blue Economy Strategies and Smart Specialisation Strategies
- Sustainable Blue Economy
- Bucharest Convention and BSIMAP

THE CONTRIBUTION OF THE BRIDGE-BS TO THE EU OCEAN PACT AND EU'S STRATEGIC APPROACH TO THE BLACK SEA

The European Ocean Pact

Sustaining the ocean that sustains us

June 2025
#EUOceanPact

A COMPETITIVE & SUSTAINABLE EU BLUE ECONOMY

OCEAN HEALTH, OCEAN PRODUCTIVITY & RESILIENCE

A ROBUST MARINE KNOWLEDGE FRAMEWORK

GLOBAL OCEAN GOVERNANCE AND OCEAN SCIENCE DIPLOMACY

ENHANCED RESILIENCE FOR COASTAL COMMUNITIES & CITIES

GOVERNANCE



SUPPORT TO MANAGEMENT AND DECISION-MAKING

data integration risk assessment multistressor projections ecosystem-based management visualisation tools resilience assessment **Black Sea DTO** cumulative effects assessment climate projections modelling frameworks early-warning systems maritime spatial planning adaptive management future scenario projections



BLACK SEA INTEGRATED ENVIRONMENTAL OBSERVATION

integrated data infrastructures environmental status updates **harmonised monitoring** basin-wide assessment genomic techniques multistressor impact assessment smart monitoring near real-time ecosystem-based observation multidisciplinary oceanographic data advanced marine sensors joint observation data integration



CAPACITY DEVELOPMENT AND OCEAN LITERACY

community engagement ocean data literacy climate awareness ocean citizenship **environmental awareness** ecosystem understanding ocean knowledge understanding human-ocean interaction marine co-management marine stewardship risk awareness informed decision-making



SCIENCE-BASED POLICYMAKING IN THE BS REGION

environmental policy knowledge transfer cross-border policy coordination intersectoral policy coherence long-term foresight **evidence-based policymaking** risk-aware decision-making knowledge uptake strategic decision processes adaptive policy frameworks **marine & maritime policy** blue economy climate-responsive policymaking ecosystem-based policy approach



The EU's strategic approach to the Black Sea

May 2025

SECURITY, STABILITY & RESILIENCE

FLAGSHIP INITIATIVE: BLACK SEA MARITIME SECURITY


SUSTAINABLE GROWTH & PROSPERITY

FLAGSHIP INITIATIVE: CONNECTIVITY AGENDA

ENVIRONMENTAL PROTECTION, CLIMATE CHANGE RESILIENCE & PREPAREDNESS, & CIVIL PROTECTION

FLAGSHIP INITIATIVE: REINFORCING PREPAREDNESS OF COASTAL COMMUNITIES AND BLUE ECONOMY SECTORS


+40 Research Papers, more upcoming!



Contents lists available at [ScienceDirect](#)

Deep-Sea Research Part I


journal homepage: www.elsevier.com/locate/dsri




Temporal variability of coccolithophore *Emiliania huxleyi* blooms in the open Black Sea: Evaluation by satellite data (1998–2020)

Oleg Yunev^{a,*}, Jacob Carstensen^b, Vyacheslav Suslin^c, Vladimir Belokopytov^c, Snejana Moncheva^d, Ludmila Stelmakh^a, Laura Boicenco^e, Oana Vlas^e

^a A.O. Kovalevsky Institute of Biology of the Southern Seas of RAS, 2 Nakhimov ave, 299011, Sevastopol, Russia
^b Dept. of Ecoscience, Aarhus University, Frederiksborgvej 399, DK 4000, Roskilde, Denmark
^c Marine Hydrophysical Institute of RAS, Kapitanskaya str, 2, 299011, Sevastopol, Russia
^d Institute of Oceanology, Bulgarian Academy of Sciences, Parvi Mai str., No 40, 9000, Varna, Bulgaria
^e National Institute for Marine Research and Development “Grigore Antipa”, Mamaia Blvd., RO-900591, Constanta, Romania





Frontiers in [Marine Science](#)

TYPE Original Research
PUBLISHED 25 September 2024
DOI 10.3389/fmars.2024.1435556

Check for updates

OPEN ACCESS

EDITED BY
Stylianios (Stelios) Somarakis,
Institute of Marine Biological Resources and
Inland Waters, Greece

REVIEWED BY
Kostas Tsiaras,
Hellenic Centre for Marine Research (HCMR),
Greece
Bernardo Patti,
National Research Council (CNR), Italy

*CORRESPONDENCE
Bettina A. Fach
✉ bettina@metu.edu.tr

Investigating the impact of cross-shelf transport and local retention in the Black Sea Rim Current system on small pelagic fishes

Bettina A. Fach*, Bulut Cagdas, Sinan S. Arkin, Baris Salihoglu and Devrim Tezcan

Middle East Technical University, Institute of Marine Sciences, Erdemli, Türkiye


nature ecology & evolution

Perspective <https://doi.org/10.1038/s41559-024-02448-y>


Aquatic deoxygenation as a planetary boundary and key regulator of Earth system stability

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Published online: 15 July 2024

Kevin C. Rose^{1,2}, Erica M. Ferrer^{3,4}, Stephen R. Carpenter⁵, Sean A. Crowe⁶, Sarah C. Donelan⁷, Véronique C. Garçon^{8,9}, Marilaure Grégoire¹⁰, Stephen F. Jane^{11,12,16}, Peter R. Leavitt¹³, Lisa A. Levin⁴, Andreas Oschlies¹⁴ & Denise Breitburg¹⁵



water



Article

An Assessment of Potential Beam Trawling Impact on North-Western Black Sea Benthic Habitats Aiming at a Sustainable Fisheries Management

Magda Nenciu¹, Victor Niță¹, Adrian Teacă², Adrian Popa^{2,3} and Tatiana Begun^{2,*}

¹ National Institute for Marine Research and Development “Grigore Antipa”, 300 Mamaia Blvd., 900581 Constanța, Romania; mnenciu@alpha.rmri.ro (M.N.); vnita@alpha.rmri.ro (V.N.)
² National Institute for Research and Development on Marine Geology and Geoecology—GeoEcoMar, 23-25 Dimitrie Onciul Str., 024053 Bucharest, Romania; ateaca@geoecomar.ro (A.T.); adrian.popa@geoecomar.ro (A.P.)
³ Doctoral School of Geology, Faculty of Geology and Geophysics, University of Bucharest, 6 Traian Vuia Str., 020956 Bucharest, Romania
* Correspondence: t begun@geoecomar.ro

TWO SRIA IMLEMENTING PROJECTS HAS ENDED WHAT'S NEXT FOR THE BLACK SEA



2025



- Danube and Black Sea Lighthouses



Final
Conferences

What's Next?

2025



- Regional calls?
- Ocean Pact
- Black Sea Strategy
- Operational Network of Funders



THANK YOU!

STAY TUNED!

bridgeblacksea.org



@BRIDGE_BlackSea



BRIDGE Black Sea



@BRIDGEBlackSea



BRIDGE Black Sea



BRIDGE-BS

FINAL CONFERENCE



25 NOVEMBER 2025



HYBRID, BRUSSELS



BARIŞ SALİHOĞLU
METU



LAURA BOICENCO
NIMRD



MARILAURE GREGOIRE
ULIEGE



SUSA NIIRANEN
SU



STEFANO MENEGON
CNR



PHILIP A. H. SMITH
BRIDGE-BS PHD STUDENT



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000240



BRIDGE-BS KEY OUTPUTS & LEGACY
SAFE OPERATING SPACE

slido

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#BRIDGE-BS



BRIDGE BLACK SEA DIGITAL TWIN OCEAN DEMONSTRATOR

Bariş Salihoğlu, BRIDGE-BS Coordinator

sabaris@metu.edu.tr

Director, METU Institute of Marine Sciences



BRIDGE-BS



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ADVANCING BLACK SEA RESEARCH AND INNOVATION TO CO-DEVELOP BLUE GROWTH WITHIN RESILIENT ECOSYSTEMS: BRIDGE-BS



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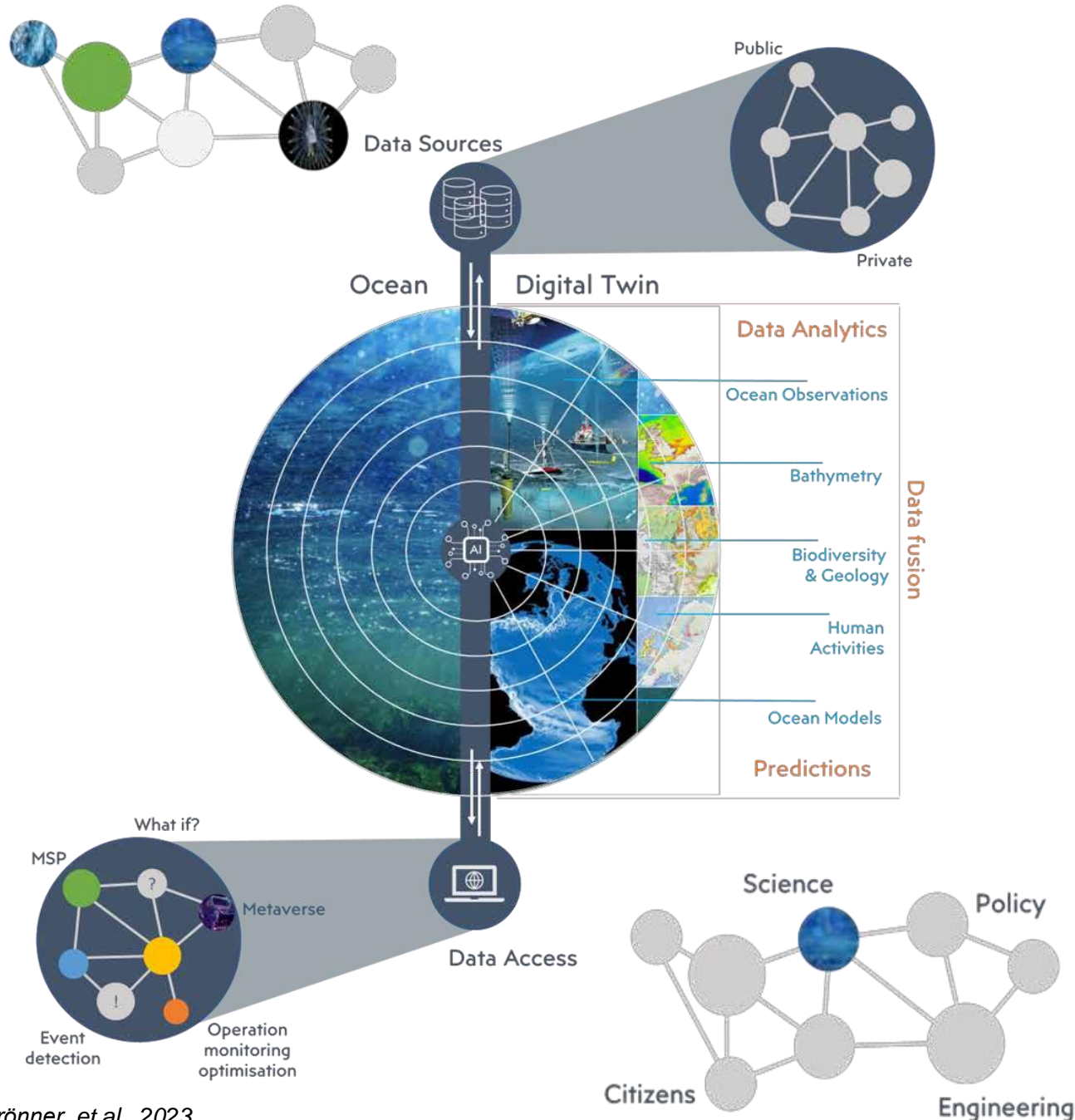
Coordinator: METU IMS (Türkiye)



BRIDGE-BS

Blue Growth Incubators | Service Dynamics | Empowered Citizens

Ocean Ecosystem



GAME CHANGER: DIGITAL TWINS OF THE OCEAN

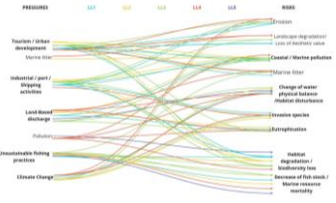
→ What do we need for a DTO?

- Virtual interaction between physical, chemical and biological properties with assets and human activities
- Data contextualization
 - Data Sources / Data lakes
 - Observations and data assimilation
- Integrating AI-driven data science and analytics
- New ways of interacting with and presentation of data
- Interoperability / Standardization
- Modelling "what-if" scenarios for decision making

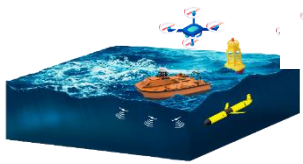
BRIDGE BLACK SEA DTO DEMONSTRATOR



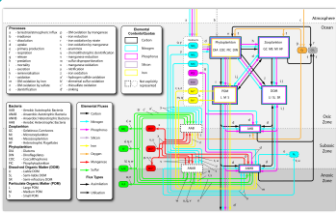
Co-Design
process
with
Stakeholder
s



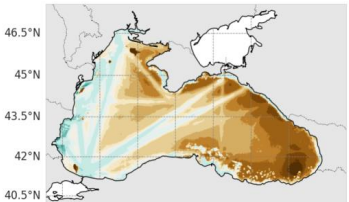
- Database
- Smart Observation & Techs



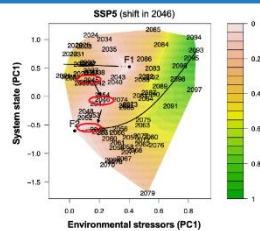
Coupled
Ensembled
Models



Risk-
based
Cumulative
Effect
Analysis



**Ecosystem
Resilience
Assessment**



BRIDGE-BS DTO Scenarios



Climate Change



Fish



Plastic



Pollution



Desired
Scenarios



AI EMULATOR

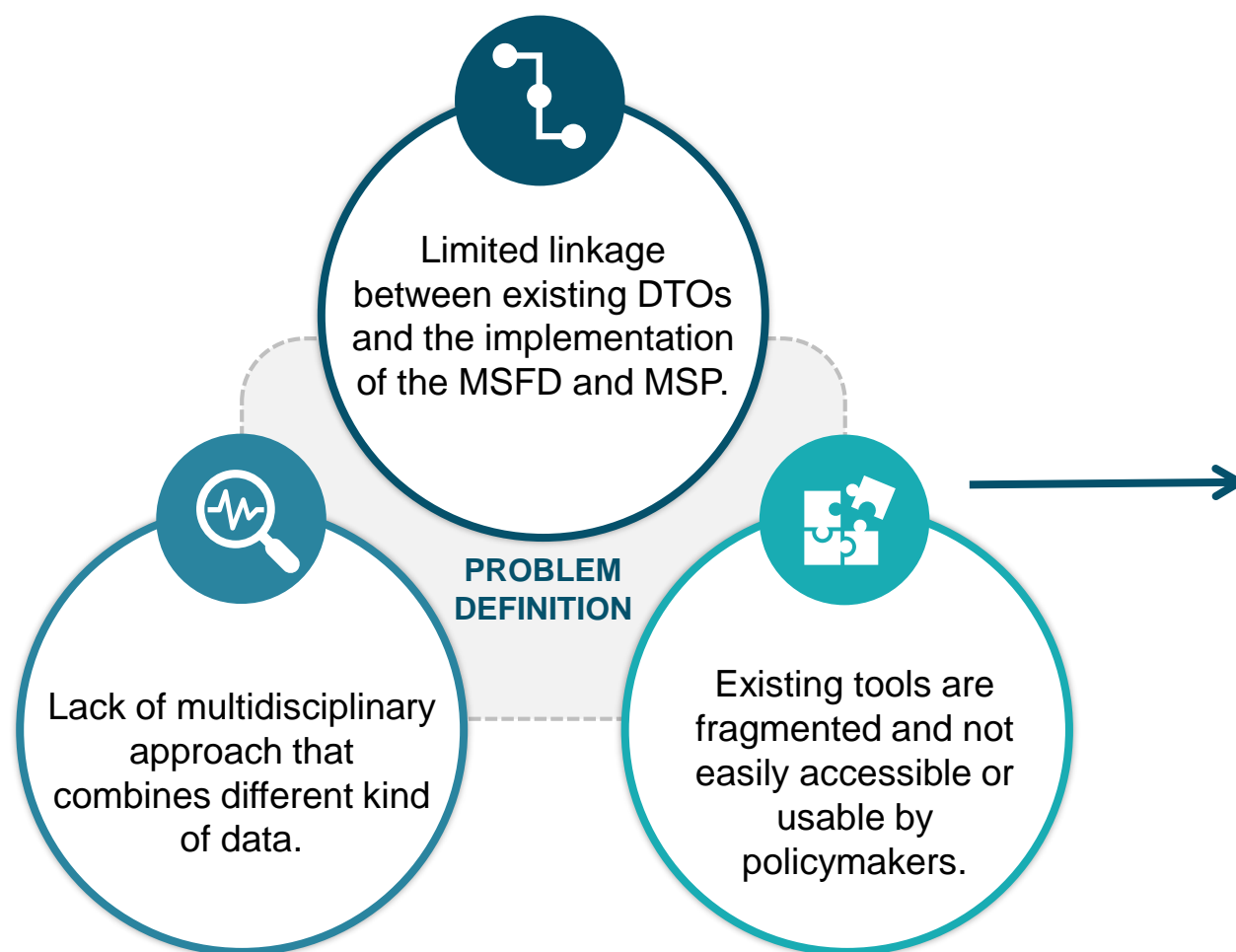
Co-designed with
stakeholders

Incorporates diverse
components and
services essential for
Safe Operating Space

**SAFE OPERATING
SPACE IN THE BLACK SEA**

EDITO  European Digital
Twin Ocean


Links ecosystem services
and MSP components,
assesses ecosystem
vulnerability (MSFD
indicators) and resilience
for holistic assessment.



Diverse components are needed to define the safe operating space of the Black Sea











BRIDGE BLACK SEA DTO DEMONSTRATOR

- ✓ A pioneering addition to the DTO framework.
- ✓ **Co-designed** with stakeholders
- ✓ Addresses **ecosystem services**
- ✓ Links ecosystem services and MSP components, assesses ecosystem vulnerability (MSFD indicators) and **resilience** for holistic assessment.
- ✓ Incorporates diverse components and services essential for defining the **safe operating space of the Black Sea**.
- ✓ Serves as a **blueprint for advancing** DTOs towards Decision Support Tools (DSTs).
- ✓ Developed with an **EDITO-ready** architecture.
- ✓ Interconnected with key data infrastructures: EMODnet, SeaDataNet, and Copernicus.




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[Data visualization](#)
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[Focus applications](#)
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[Playground](#)

 **Grafana**


Launch Strimlit APP.

Launch

 **Surimi-gui**


Launch the SURIMI Test 4317

Launch

 **Sargassum-backend**


API to monitor sargassum trajectories in the Ocean

Launch

 **Nguyen-dummy-service**


Launch a Opendrift jupyter notebook

Launch

 **Ades**


ADES in EDITO

Launch

 **Stacify**


STAC catalog generator with Streamlit UI for NetCDF/Zarr datasets

Launch

 **Simple-gpu-pytorch**


The JupyterLab IDE with Python and the deep-learning framework PyTorch, with GPU support.

Launch

 **Bridge-dto-app**


Interactive Black Sea Digital Twin web app developed at METU-IMS under BRIDGE-BS

Launch

 **Microplastics-attribution**


Launch a Microplastics Viewer Web App.

Launch

 **Terria-map-ger**


Launch a Terria Map viewer.

Launch

 **Rstudio-globaltunaatlas-shinyapp-tunaatlas-pie-map-shiny**




Rstudio with all the data, the code and the packages to run and explore the tunaatlas_pie_map_shiny app and repository

Launch


 **The-ocean-bulletin**

The Ocean Bulletin is an AI-powered platform by Amphitrite that provides fine-scale ocean current data to optimize short-sea shipping routes and reduce fuel consumption by up to 7%.

Launch

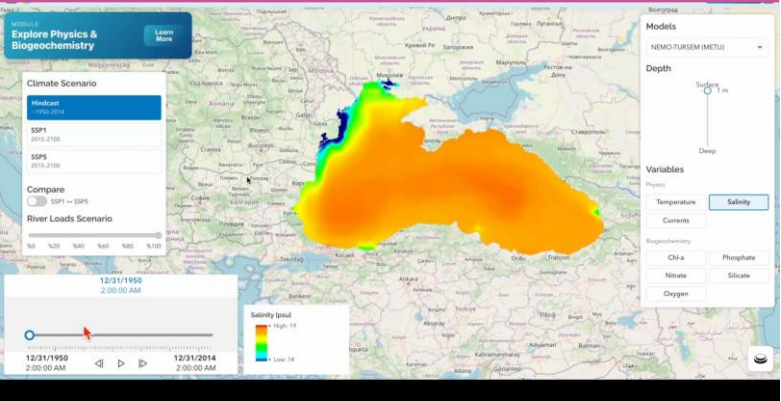
2022 - 2025 EDITO Infra

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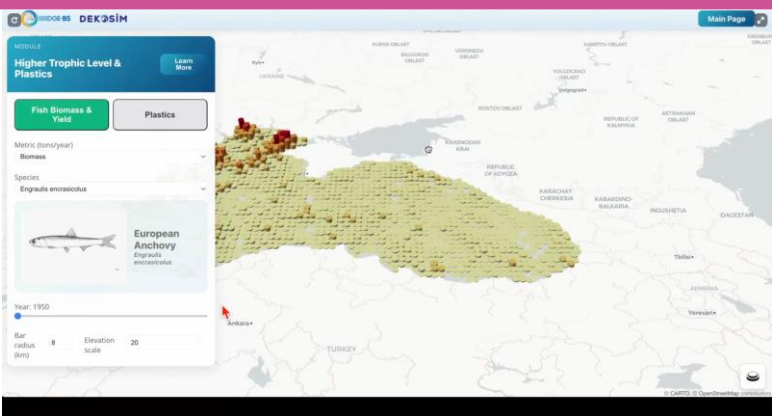
BRIDGE BLACK SEA DIGITAL TWIN OCEAN DEMONSTRATOR

One of the First Examples of Digital Twin Ocean Demonstrators

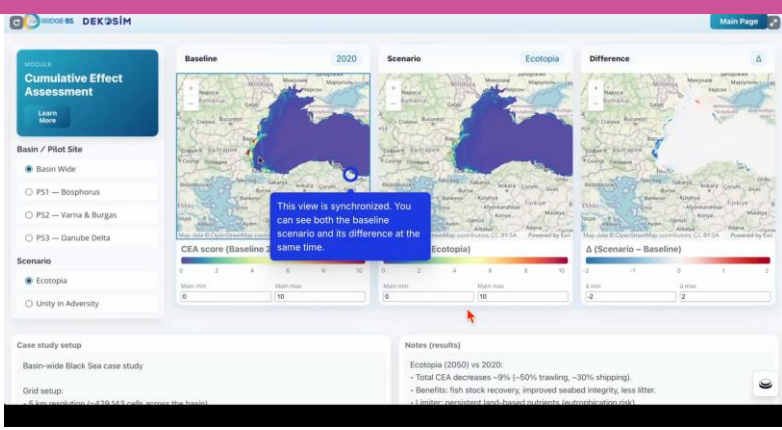
EXPLORE PHYSICS & BIOGEOCHEMISTRY



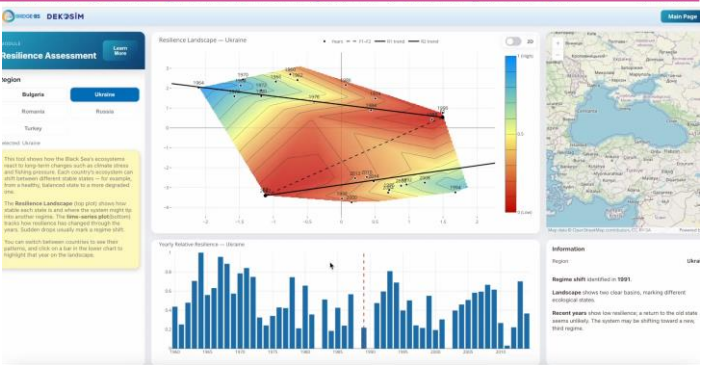
HIGHER TROPHIC LEVEL & PLASTICS



RISK-BASED CUMULATIVE EFFECT ASSESSMENT



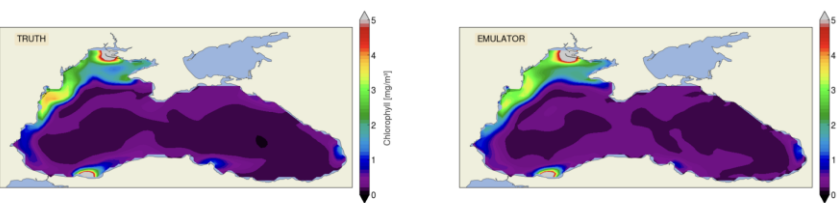
RESILIENCE ASSESMENT



AI-BASED EMULATOR

Prediction 2000-2014

Global metrics	
RMSE	0.3586 mg/m ³
Bias	0.0467 mg/m ³
CorrR	0.9538



TEASER!

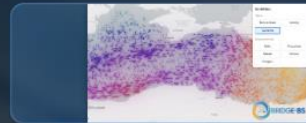
BRIDGE BLACK SEA DIGITAL TWIN OCEAN DEMONSTRATOR

One of the First Examples of Digital Twin Ocean Demonstrators

The Horizon 2020-funded **BRIDGE-BS (Advancing Black Sea Research and Innovation to Co-Develop Blue Growth within Resilient Ecosystems)** aims to advance the Black Sea's marine research and innovation to co-develop Blue Economy pathways under multi stressors for the sustainable utilization of the ecosystem services. The 4.5-year project started in 2021 and will end in November 2025.

BRIDGE-BS is designed to define a safe operating space for the Black Sea Blue Economy, ensuring that ecosystem boundaries are known and respected. To achieve this, the project has developed, for the first time in the region, an ensemble modeling framework that provides critical insights into the resilience of the Black Sea which has never been analyzed before. These models, supported by new ecosystem and socio-economic data, deliver results on ecosystem state under different climate and human-driven pressures. The outputs feed into AI emulators, cumulative effect assessment tools, and "what-if" scenarios, while also supporting the development of multi-stressor, multi-service Decision Support Tools and adaptive management strategies at both basin-wide and Pilot scales. Living Labs across different regions provide additional stakeholder-driven input, reinforcing the co-design of Digital Twin Ocean applications and enabling risk-based assessments that guide sustainable management of the Black Sea.

Black Sea DTO will be maintained by **DEKOSIM (The Center for Marine Ecosystems and Climate Research)** infrastructure hosted by Middle East Technical University beyond BRIDGE-BS.



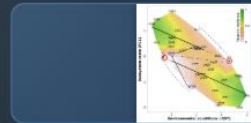
Explore Physics & Biogeochemistry

Explore how the sea evolves under SSP future projections — visualize physical processes and biogeochemical cycles.

[Launch](#)

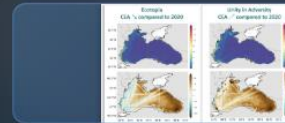
Higher Trophic Level & Plastics

Visualize fish biomass, yield, and marine plastics distribution.

[Launch](#)

Resilience Assessment

Assess ecosystem & community resilience through indicators.

[Launch](#)

Cumulative Effect Assessment

Explore how multiple human activities and climate drivers cumulatively impact the Black Sea ecosystem

[Launch](#)

Blue Economy Observatory

Monitor and explore socio-economic trends driving the Black Sea Blue Economy through interactive dashboards, indicators, and country fact sheets

[Launch](#)

AI-Based Ecosystem Emulator

Using hybrid Bayesian–Neural Network frameworks the emulator predicts phytoplankton dynamics, ecosystem responses, and stressor–impact relationships across the Black Sea.

[Coming Soon](#)

Data Services

REST + ERDDAP endpoints for model/data access.

[Launch](#)

JupyterLab

Access the interactive JupyterLab environment to explore, analyze, and visualize model outputs and observation datasets directly.

[Coming Soon](#)

Trainings and tutorials

Step-by-step guides to use the DTO—from map navigation and scenario simulation to data download, Jupyter notebooks, and APIs

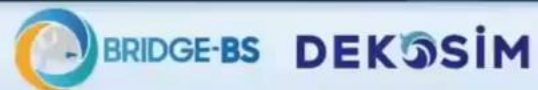
[Coming Soon](#)

Explore the BRIDGE Black Sea Digital Twin Ocean Demonstrator

Get Started

explore the future of the Black Sea! • Join us at the BRIDGE-BS Final Conference on 25 November 2025 in Brussels!

The BRIDGE



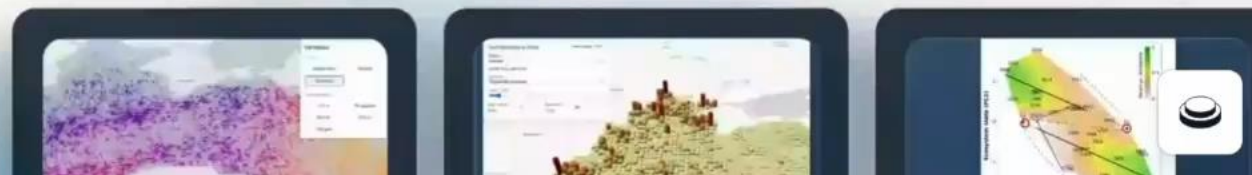
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Black Sea DTO will be maintained by **DEKOSIM (The Center for Marine Ecosystems and Climate Research)** infrastructure.



THANK YOU!

STAY TUNED!

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25 NOVEMBER 2025



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LAURA BOICENCO
NIMRD



MARILAURE GREGOIRE
ULIEGE



SUSA NIIRANEN
SU



STEFANO MENEGON
CNR



PHILIP A. H. SMITH
BRIDGE-BS PHD STUDENT



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101000240



BRIDGE-BS KEY OUTPUTS & LEGACY
SAFE OPERATING SPACE

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BETÜL BİTİR SOYLU
BRIDGE-BS PHD STUDENT



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**BRIDGE-BS KEY OUTPUTS & LEGACY
FROM COMMUNITIES TO
POLICY AND INNOVATION**